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ABSTRACT

This essay suggests to schools ways in which to get more girls interested in science and technology. The sections of this essay are as follows: (1) "Why Are There So Few Girls Studying Technology?"; (2) "Why is it Important to Get More Girls Interested in Science and Technology?"; (3) "How to Get More Girls Interested in Science and Technology?"; (4) "Recommendations for Action"; and (5) "What is the Situation for Women Technology Students?" Seven recommendations for increasing girls interest in science and technology are provided and include: (1) practical technology for small girls; (2) special theme and role-plays for children and teachers; (3) spare time activities and theme courses in technology; (4) engineering students assist with technology instructions at schools and at special courses; (5) female technologists tell young people about their education and occupation; (6) create small activity centers in science and technology; and (7) girls who have made non-traditional choice must be supported. (KR)

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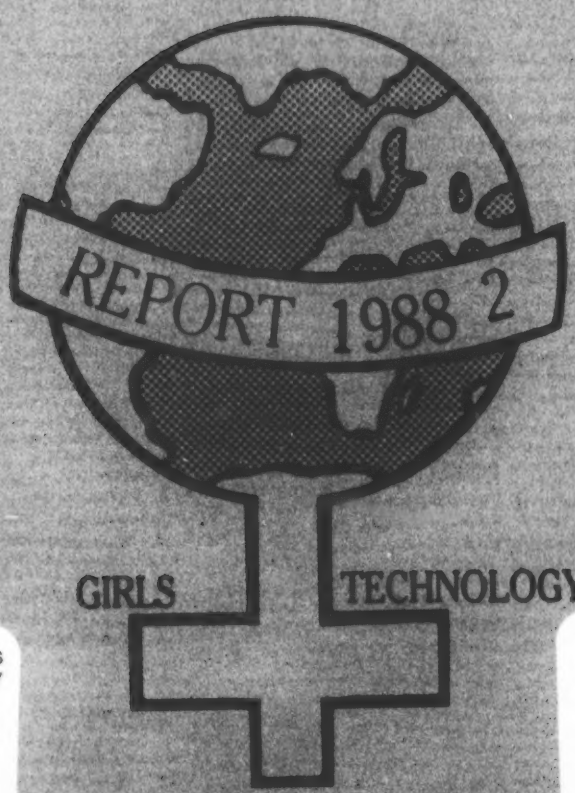
GIRLS AND WOMEN IN SCIENCE AND TECHNOLOGY EDUCATION

Ingrid Granstam



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Department of Technology
Report No 2, 1988

JÖNKÖPING UNIVERSITY COLLEGE
Department of Technology

ABSTRACT

Ingrid Granstam

GIRLS AND WOMEN IN SCIENCE AND TECHNOLOGY EDUCATION
Contribution to UNESCO Report, Innovations in Science and Technology Education.

Report
No 2, 1988 ISSN 0284-5911

This essay will suggest to schools how to get more girls interested in science and technology.

At present, school is obviously not successful in interesting girls in science and technology. It is therefore essential that new methods are worked out for these subjects at all levels of education.

In order to increase the interest of girls in technology and to bring about a change in girls' traditional choice of subjects and course programs, certain measures are needed and it is also essential to start long-term activities.

Technology affects our daily living and our vision of the future more profoundly than at any previous stage of history. In a world increasingly dependent of technology, where problems and solutions tend to be framed in technical terms, technology is everybody's business - or ought to be. Yet statistics clearly show that university studies and professional engagement in science and engineering are dominated by one gender.

Keywords: Girls, Women, Science, Technology, Female technologist, Female engineer, Education, Training

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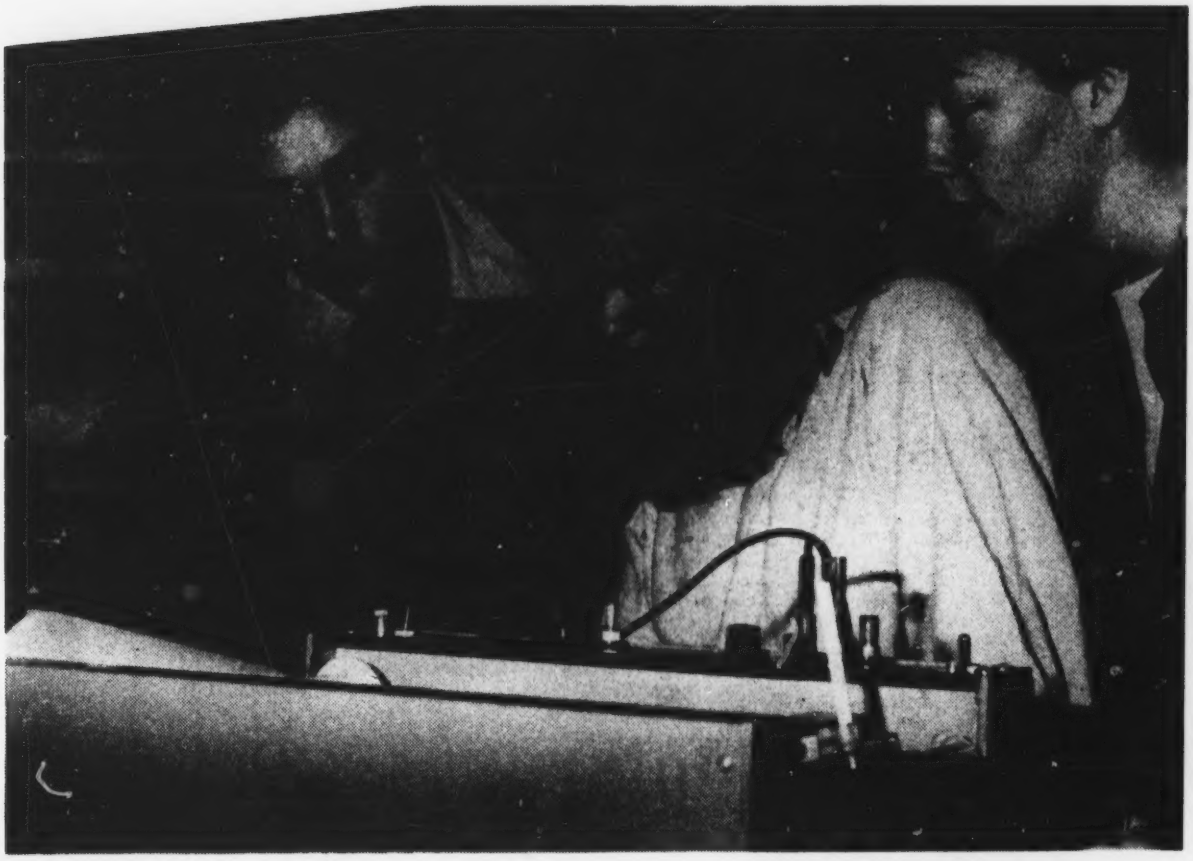
GIRLS AND WOMEN IN SCIENCE AND TECHNOLOGY EDUCATION

Contribution to UNESCO Report, Innovations in Science and Technology Education.

Ingrid Granstam



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Report

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GIRLS AND WOMEN IN SCIENCE AND TECHNOLOGY EDUCATION

By Ingrid Granstam

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RECOMMENDATIONS FOR ACTION:

- Practical technology for small girls
- Special theme and role-plays for children and teachers
- Spare time activities and theme courses in technology
- Engineering students assist with technology instructions at schools and at special courses
- Female technologists tell young people about their education and occupation
- Create small activity centres in science and technology
- Girls who have made non-traditional choice must be supported

WHAT IS THE SITUATION FOR WOMEN TECHNOLOGY STUDENTS?

DISCUSSION

WHY ARE THERE SO FEW GIRLS STUDYING TECHNOLOGY?

Everything indicate that the girls' attitude towards technology is established at a very early age. The notions regarding technology and technical education are formed during pre-school age, in the compulsory school and in the upper secondary school. The difference in attitude of girls and boys to technical and science subjects at the age of ten is already substantial, largely due to differing experiences.

Girls often lack self-confidence and do not believe themselves capable of coping with technical matters even if they enjoy mathematics and also physics and would make very good engineers.

People around them also take it for granted that boys' interests lie within the technical-scientific area, whereas they assume girls to be disinterested in these subjects.

At present, school is obviously not successful in interesting girls in science and technology. It is therefore essential that new methods are worked out for these subjects at all levels of education.

In order to increase the interest of girls in technology and to bring about a change in girls' traditional choice of subjects and course programs, certain measures are needed and it is also essential to start long-term activities.

WHY IS IT SO IMPORTANT TO GET MORE GIRLS INTERESTED IN TECHNOLOGY?

The labourmarket is one of many reasons to encourage more girls to the study of science and technology. Girls usually choose their professions from a much more limited range than boys do. An increasing number of occupations are technical and if more girls studied technology at different levels less girls would be unemployed. The girls would get interesting and developing occupations with an option to work within or outside their own country and with a variety of tasks.

Society would also profit from more female engineers. Probably they would broaden technical research, as women often have other interests than men. Thus the situation would be more balanced if both men and women were engineers and scientists.

HOW TO GET MORE GIRLS INTERESTED IN TECHNOLOGY?

But how can we get more girls interested in technology?
In different ways we can inform girls about the studies and the labourmarket. Very often girls don't reckon they can be successful in technical subjects, as an interest in technology has traditionally been regarded something specifically male. The attitude towards women and technology must be changed, not only in society in general but also with the girls themselves. It is therefore important that girls get an opportunity to meet female engineers and scientists, female technology students and that girls study some technology themselves. Having get such information many girls say that technical studies are an option.

We must interest girls in science and technology at a very early age, perhaps as early as at the age of five and then technology must be on the curriculum all through school. It is necessary to present the subject on the right level to avoid that the children feel it is to difficult or to easy for them. In addition the teachers must be trained in technology, since all too often teachers have a negative attitude due to ignorance, which they pass on to their pupils. A playful approach to technology is important at the early stages.

Mass media and activity centres can all be used for a positive and informative presentation of popular science.

How to get girls interested in technology? Through:

- personal information
- model female engineers
- technology experience

- very early introduction
- technology as a school subject
- teachers training
- positive information from press and radio
- science centres close to school

RECOMMENDATIONS FOR ACTION:

Practical technology for small girls

One way to get small girls interested in technology is through amusing and exciting experiments.

Both boys and girls are usually interested in construction work like, for example, building bridges. The teacher can construct a model of a landscape, consisting of a river flowing through a small town. Also small children can be motivated to construct a variety of bridges strong enough for a lorry to cross the river. The pupils can use their imagination and create bridges from paper, tape glue and straw. Bridge construction is interesting for pupils of different age, not only the very young ones.

The older children can compete in building a bridge with a given amount of material and possibly also with given dimensions. The children can compare the bridges and find out which one will get the smallest deflection from a certain load and also study which one can carry the heaviest load.

A suspension bridge can be built between two chairs with a board and a rope. It can be built big enough for a child to lie on.

The children can also collect pictures of bridges and draw their own ones.

It can be interesting to talk about spectacular accidents which have happened to bridges due to heavy wind, overload or some other casualty, i e a ship collision. The children can discuss how the bridges can be reinforced. Similarly the pupils can make towers.

It is also creative to work with different themes, like a harbour, a town or an amusement park. The children can then build different models appropriate to the theme, using a variety of material such as cardboard, wood, modelling clay, flower pegs or even Fischer- or Legotechnique. Later the models can be brought together to form an exhibition, which can be shown to parents as well as to other forms. The project can be followed up with an excursion so that the children get an opportunity of seeing an actual harbour, town or amusement park and compare their models with reality.

Boys often show more self-confidence in these activities. It is therefore important to support the girls to conquer their misgivings. Then they will cope with the tasks equally well as the boys - or even better.

Another example of what can be done with young pupils is to study these six basics both theoretically and practically: the lever, the inclined plane, the screw, the wedge, the wheel and the pulley.

That is to illustrate that a machine is anything which makes work easier, because it helps us one way or the other to push or pull. All our complicated machines are based on two or more simple basics, which have existed for thousands of years, that is why it is so important to make children understand the use of these basics.

One way to get girls interested in technology which we must not forget is to explain everyday technical phenomena to them as they are often curious about things in the surrounding.

As a rule pupils get interested in a subject if practical experiments are sandwiched with teoretical explanations.

Special themes and role-plays for teachers and pupils

As early as in nursery school the children can be introduced to various technical occupations.

For example, one can discuss the roles people play in building up a district of a town: Who designs the houses and who decides what they will look like and what buildings are needed? What do the workers do on a building site? What does a bricklayer, etc, do? How do the various people interact? What machines and tools are used? Maybe one of the parents has this kind of job and can talk about his or her work. It would be even more appropriate if one of the mothers had an untraditional technical job! The children can visit a building site, where they can look at various machines and compare different buildings. Back at school the children can act the parts of different construction workers in role-plays. One can also cut pictures out of magazines and with these make an album of building-site pictures. Finally they can build a model of a building site at school. In this case the children must plan their construction work carefully and share the work between themselves, thus they also get practice in team work.

If the aim is to teach the children something about an engine driver's job, they can be given information about it through role-play, collecting pictures of railways, a study visit to a railway station and a ride in a train. Finally, they can build a model railway at school.

Other themes might be: technology at home, technology in agriculture, technology in hospitals, etc.

Spare time activities and theme courses in technology

Appropriate measures to bring about a more rapid change can be to arrange seminars in technology for students in teachers' training colleges and practical training of instructive technical experiments. Similar seminar programs can also be used for retraining of teachers at different levels.

More time must be devoted to natural sciences in the training of class and nursery school teachers. It is also extremely important to emphasize physics, mechanics and mathematics in compulsory school.

The teachers must become aware of their great importance for changing old attitudes and prejudice.

Summer and afternoon courses can be arranged for both girls and boys and perhaps also for their parents with engineering students as leaders. In a variety of ways they can try to bring technology to life for their pupils.

Special computer courses for girls are useful to get more girls interested in computer science. There are still very few female students at computer engineering at university level.

Engineering students assist with technology instructions at school and at special courses

At an institute of technology a number of activities can be arranged to increase girls' interest in technology. Different projects can be carried out with female technology students as trainers in comprehensive schools. The activities may be focused on girls in the compulsory school, but also the boys will be included.

The female technology students act both as teachers and as positive models for the young girls. It is good for the children to get young enthusiastic trainers, who are interested in science and technology even if they don't know everything about the subjects. It is also good for the ordinary teachers to meet these engineering students. The teachers can learn that you can do something suitable in technology with your pupils, even if you are not an expert in the subject.

Science and technology are very far-reaching subjects and you can always begin with one small part and then there are endless possibilities to expand the studies according to the teachers' own interest.

In fact the pupils find it exciting when they realise that their teacher also must learn new things and they can work together with new methods and find solutions to different problems.

If there is no institute of technology nearby, you can let older pupils teach younger ones in science and technology. It is often good also for the older pupils to have to explain different problems for the younger ones. Then they must learn the subject in a better way to be successful.

Some experiments which can be done with students as trainers are bridgeconstructions, electric motors, electronic dice and digital clocks but they can also teach the younger pupils about basic tools, electricity and magnetism, light and sound and various other things.

Female technologists tell young people about their education and occupation

It is important that female technologists tell young people about their education and occupation to provide the girls with positive models so they will look upon female engineers as quite natural. You can often hear young pupils say they have never met a female technologist and they therefore wonder what kind of girls are studying technology. Sometimes they think female technologists are very clever geniuses, to whom mathematics and physics is obvious. Therefore it is good for them to meet young technologists and see, that they are just like anybody else.

It is also useful for the technical students to participate in information meetings about technical education and discuss the perspective of women and technology. This information must focus girls of various ages and their parents as well as career counselors and different categories of teachers.

Elementary school students must get adequate information about technical education before choosing subjects at upper secondary school.

You can work with technology at many different levels and therefore it is imperative for girls to meet scientists and technologists in different occupations.

Efforts should be made to change students', teachers' and parents' attitudes towards women's possibilities of gaining a technical education and occupation.

Even the role of mass media is very important and instructive programs in radio and television which show female technologists working with science and technology help to interest girls in these areas. Articles about popular science can also have a positive effect. Especially if it is a female scientist who is the author!

Create small activity centres in science and technology

Small science centres can be created in different parts of the country, where people of all ages are welcomed and encouraged to learning by doing. These activity centres are good example of what can be done to make technology and science interesting for young people as well as for their parents and teachers. Physical phenomena are explained and shown in a pleasant way.

Science centres, not to far from school are very useful to teachers in order to illustrate science and technology. A lot of different activities can be allocated to a centre like this, i e lectures about popular science, actualities in technology, training courses for adults, special school programs, discovery rooms for children and boxes with material which can be borrowed from the centre.

An old chinese adage is often quoted at science centres:

" I hear and I forget
I see and I remember
I do and I understand"

It says something important about the philosophy from which the idea of science centres has grown.

Girls who have made non-traditional choices must be supported

The girls who have made the non-traditional choice of technical studies must be supported and encouraged by everyone around. The girls' self-confidence will be strengthened if they know that others care about them. In the technical upper secondary school it is more common for girls than for boys to give up their studies.

WHAT IS THE SITUATION FOR WOMEN TECHNOLOGY STUDENTS?

If you ask female technology students why they began to study at an institute of technology, many of them will say, that it is their interest in mathematics and physics that has decided their choice of career. If you ask male technology students the same question they nearly always say: "because of my interest in technology".

Girls often feel inferior to male technologists in the matter of technical attitudes and the prerequisites for technical studies.

It is therefore important to let even young girls be familiar with science and technology. Sometimes you can hear female students talk about how much they enjoyed as a child to take part in their fathers' technical job. It seems as these early experiences were decisive for their later studies in technology.

Good grades in different subjects of science are considered to be very important for successful engineering studies. You can often find that girls' average marks are higher than boys' in mathematics and chemistry, while boys' marks are higher in physics.

When female students decide to study engineering their parents usually react positively to their choice. Many of the students' friends, however, are not aware of what engineering studies mean and they sometimes feel that the studies are too extensive.

If the female students are not supported by people around them they run the risk of quitting their studies before graduation. In many surveys, however, the drop-out at an university level is not greater for girls than for boys.

Both the male and female engineering students generally like studying at an institute of technology. On the whole women technology students get on well with one another, with their fellow male students as well as with their teachers. Some students mention that it can even be an advantage to be a woman both in working life and at an institute of technology. Women who have graduated are positive to their profession. They are usually well accepted and they are not discriminated at work due to their sex.

Sometimes female students and engineers are prejudiced against engineering careers although only very few women really have experienced any disadvantage at work. Therefore there is no practical reason why we should not encourage girls to undergo technical education and try to get more of them interested in technology.

DISCUSSION

This essay will suggest to schools how to get more girls interested in science and technology. This business of technology affects us all - women as well as men - and so even little girls must get practice in technology, so that they will not feel inferior to men later in life in these matters.

It has sometimes been said in the West European press that our age can be characterized as anti-intellectual. This has also affected attitudes to technical subjects. Fear of technical development sometimes shows in a contempt for technology, and this tends to be more common in women than in men. Many problems in our society must be solved with a technique, that is somewhat different in its social orientation.

If more women had a technical education, it is conceivable that this would broaden technical development and thus benefit society.

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